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ABSTRACT

This paper argues that Chomsky's and Halle's restriction on the features [+high, +low] are too severe; that this restriction is inconsistent with the generative treatment of affricates, laterally-released stops, and prenasalized stops; and that the restriction is inconsistent with the notion that linguistic descriptions are abstract theories about cognitive structures. Research was supported in part by a grant from the Office of Education, U.S. Department of Health, Education, and Welfare to the Pacific and Asian Linguistic Institute (PALI) of the University of Hawaii. A brief bibliography is included. (DD)

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On the Mental Basis and Some Physical Aspects of Tongue-Height Features

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The Mind is mightier
than the Tongue..
D. Steinberg

Chomsky and Halle in *The Sound Pattern of English* (1968, hereafter SPE) have asserted that the tongue-height features [+low] and [+high] cannot be assigned to the same segment. They support their claim with the obviously correct observation that the tongue cannot be lowered and raised simultaneously. It will, however, be argued here that their restriction on the features [+low, +high] is too severe since it rules out a very natural way of characterizing certain true diphthongs, e.g. /a^{I} ɔ^{I} a^{U}/ as in *tie*, *toy*, and *cow*. Furthermore, it will be shown that this restriction is not consistent with the generative treatment of affricates, laterally-released stops, and prenasalized stops. Finally, it will be argued that the restriction is not consistent with the generally-accepted notion that linguistic descriptions are abstract theories about mental structures and processes, which must by their very nature go beyond statements about the behavior of the tongue and other vocal organs.

Chomsky and Halle's position on the tongue-height features is extremely clear:

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> We must observe only that the phonetic characterization of "low" and "high" rules out sounds that are [+low, +high], for it is impossible to raise the body of the tongue above the neutral position and simultaneously lower it below that level. (SPE:305)
>
> ...it is impossible, by definition, to have segments which are [+low, +high]. (SPE:404)
>
> ...there can be no segments that are [+high, +low]. (SPE:408)

While it is obvious, of course, that the two features cannot be articulated simultaneously, it is not obvious that this fact necessarily rules out another possibility, that of realizing the features sequentially, e.g. having [+low] followed by [+high]. A sequencing of the features in this particular order corresponds in articulatory terms to a movement of the tongue from a lower to a higher position. Since such a movement takes place during the production of /a^I $ɔ^I$ a^U/, assigning [+low, +high] to the underlying segments of these diphthongs provides a natural way of characterizing certain physical aspects of these sounds.

This sequencing of [+low, +high] is parallel to the sequencing of [-continuant, +strident] implicit in Chomsky and Halle's treatment of the affricates /$t^{\check{s}}$/ and /$d^{\check{z}}$/. In addition, it is parallel to the sequencing of [-continuant, +lateral] implicit in their treatment of the laterally released stop /t^{l}/ (SPE:317). Notice that although it is physically impossible to realize the features [-continuant, +strident] simultaneously, Chomsky and Halle assign these features to a single underlying

segment. Similarly, although it is impossible for the tongue to be in the [-continuant] position and simultaneously in the [+lateral] position, Chomsky and Halle assign both of these features to a single underlying segment also. Since it is clear that the impossibility of a simultaneous realization of two features has not been sufficient to prevent their assignment to a single underlying segment, it appears that Chomsky and Halle's explicit restriction on the features [+low, +high] is not consistent with the practice implicit in their analysis of certain consonants. It might be suggested here that if linguistic theory allows the sequencing of consonant features, that it either allow the sequencing of vowel features or provide sufficient justification for the difference in treatment.

A sequencing of features corresponds in physical terms to a movement of a vocal organ within the limits of a single segment. It is interesting to note that such a movement has been explicitly allowed by Chomsky and Halle in their analysis of prenasalized stops, such as /^{m}b/. They note (SPE:317) that 'the velum...is lowered during the period of oral occlusion [and] is raised prior to the release of the oral occlusion' and suggest that 'we have to recognize a feature that governs the timing of different movements within the limits of a single segment.' It might be suggested here that if linguistic theory allows the movement of the velum within the limits of a single segment, that it either allow a similar movement of the tongue or provide sufficient justification for the difference in treatment.

Our discussion of phonological features thus far has included a consideration of the activity of the vocal organs. Although language activity in the mouth is certainly an important part of the process of speech production, it is obvious that it is only one part of the physiological activity involved in speaking. Since the production of speech begins in the brain of the speaker, perhaps it is not unreasonable to suggest that whether or not two features can be simultaneous might actually be a question of whether or not their physical correlates can be simultaneous somewhere along the path of transmission that leads from the brain to the articulatory organs. In an interesting discussion that sheds some light on this question, Kim (1971) presents evidence in favor of the hypothesis that the syllable rather than any smaller entity is the minimum unit of speech production, i.e. that 'segments within a syllable receive a simultaneous package of instructions for articulation.' Here it is important to remember that the diphthongs /a^I $ɔ^I$ a^U/ are each the nucleus of a single syllable. If Kim is correct, then it follows that the instructions for the production of a diphthong are all sent out at one time. Thus the complex instructions for /a^I/ (which determine that the tongue is in a lower position and is subsequently moved to a higher one) are issued simultaneously. This would suggest that even from a purely physical point of view, the simultaneity of the tongue-height features [+low, +high] is possible.

In addition to investigating various physical aspects of the tongue-height features, we may wish also to examine the features from the

point of view of mentalistic linguistics. As is well-known, phonological representations are hypotheses about mental representations. Consequently, whether or not the features [+low] and [+high] can be assigned to the same segment is primarily a question about the limitations upon human mental structures and processes. While the movements of the tongue and other organs are, of course, of interest, there is, however, no apriori reason to assume that the principles underlying human cognitive processes resemble those underlying tongue movements in any way. Instead, given the abstract nature of mentalistic linguistic theory, it appears that whether or not it is possible by definition to have segments that are [+low, +high] will have to be based on more than a mere summary of the observed behavior of the tongue.

The abstract and mentalistic nature of linguistic theory is discussed by Chomsky in many places. Some fairly typical comments follow:

> It seems to me that the most hopeful approach today is to describe the phenomena of language and of mental activity as accurately as possible, to try to develop an abstract theoretical apparatus that will as far as possible account for these phenomena and reveal the principles of their organization and functioning, without attempting, for the present, to relate the postulated mental structures and processes to any physiological mechanisms or to interpret mental function in terms of "physical causes." We can only leave open for the future the question of how these

> abstract structures and processes are realized or accounted for in some concrete terms, conceivably in terms that are not within the range of physical processes as presently understood--a conclusion that, if correct, should surprise no one. (Chomsky 1972:14)
>
> Hence, in the technical sense, linguistic theory is mentalistic, since it is *concerned with discovering a mental reality underlying actual behavior*. Observed use of language or hypothesized dispositions to respond, habits, and so on, may provide evidence as to the nature of this mental reality, but surely cannot constitute the actual subject matter of linguistics, if this is to be a serious discipline. [Italics mine--RK] (Chomsky 1965:4)

One may wish to modify some of the above statements to emphasize their relevance to phonology: Phonological theory is mentalistic, since it is concerned with discovering a mental reality underlying actual behavior, e.g. the behavior of the tongue. Observed use of the tongue and other vocal organs may provide evidence as to the nature of this mental reality, but surely cannot constitute the actual subject matter of phonology.

In mentalistic linguistics, performance data--including, no doubt, statements about the performance of the tongue--provide only one part of the evidence used in the construction of a linguistic description:

> Mentalistic linguistics is simply theoretical linguistics that uses performance data (along with other data, for example, the data provided by introspection) for the determination of competence, the latter being taken as the primary object of its investigation. The mentalist, in this traditional sense, need make no assumptions about the possible physiological basis for the mental reality that he studies. (Chomsky 1965:193)

There is no apriori reason to assume that the limitations upon phonological, i.e. mental,representations are necessarily the same as those upon tongue movements. In particular, there is no reason to assume that the mind is simpler than the tongue. Chomsky has made similar comments:

> It seems to me that the essential weakness in the structuralist and behaviorist approaches to these topics is the faith in the shallowness of explanations, the belief that the mind must be simpler in its structure than any known physical organ and that the most primitive of assumptions must be adequate to explain whatever phenomena can be observed. (Chomsky 1972:25-6)

One cannot assume in advance that elaborations on the gross movements of vocal organs will determine the principles of mental organization and the principles of assigning features to underlying segments:

> It would be mere dogmatism to maintain without argument or evidence that the mind is simpler in its innate structure than other biological systems, just as it would be mere dogmatism to insist that the minds' organization must necessarily follow certain set principles, determined in advance of investigation and maintained in defiance of any empirical findings. I think

> that the study of problems of mind has been very definitely hampered by a kind of apriorism with which these problems are generally approached. (Chomsky 1972:80)

In view of the above quotations about the abstract nature of linguistic descriptions, it might be the case that Chomsky and Halle's restriction on the features [+low] and [+high] perhaps does not conform to their actual intentions. In any case, unless evidence is brought forth to support their restriction, there is no reason to retain it as part of generative phonology.

In summary, what is at issue here is not merely the question of whether [+low] and [+high] can be assigned to the underlying representations of true diphthongs, but rather whether phonological hypotheses are assumed to be strictly limited by descriptions of articulatory movements. It is not unlikely that by restricting a theory of phonology too greatly in this respect, a linguist may be prevented from making significant hypotheses about neurophysiological phenomena and ultimately about mental structures and processes. However, if we free ourselves from an over-dependence on summaries of observed behavior and from an attachment to the most superficial aspects of linguistic activity, and furthermore if we assume the notion of sequencing discussed above, it should be clear that assigning the features [+low] and [+high] to the same underlying segment boggles neither the mind, nor the tongue.[1]

NOTE

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